Draft

ATK LAUNCH SYSTEMS
GROUND WATER SAMPLING AND ANALYSIS PLAN
FOR BACCHUS WORKS FACILITY

December 2007

Draft
ATK LAUNCH SYSTEMS
GROUND WATER SAMPLING AND ANALYSIS PLAN
FOR BACCHUS WORKS FACILITY

1.0 PURPOSE AND SCOPE

This plan specifically addresses the sampling of ground water monitoring wells at ATK Launch Systems Bacchus, Utah-based Operations. The location, number, and description of each well have been submitted previously to the Utah DSHW. The plan addresses all procedures for taking ground water samples, shipping the samples for analysis, and methods for analyzing samples. Groundwater in many areas throughout of the Bacchus facility has historically contained elevated concentrations of various solvents and explosive constituents. The goal of this plan is to collect groundwater samples that are representative of in-situ groundwater conditions and to minimize changes in groundwater chemistry during sample collection and handling.

The purpose of this chapter is to present (1) techniques or procedures which are common to all sampling methods presented in this document; (2) chain of custody documentation requirements; (3) sample handling methods; (4) field quality control procedures; and (5) records management requirements. All of these topics are referred to throughout the document; thus, they are discussed here to avoid excessive repetition in each chapter.

1.1 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment is a necessary and important portion of the sampling protocol. Decontamination of sampling equipment reduces the probability of cross-contaminating samples and sampling stations or monitoring wells. All equipment and instruments utilized in the sampling process must be properly decontaminated prior to collection of the first sample during a given sampling campaign, between subsequent samples, and following collection of the final sample of a given sampling campaign.

Proper decontamination can not be over emphasized. It is critical if representative samples are to be collected and if contamination or dilution of samples is to be avoided. Improper decontamination could result in costly re-collection and re-analysis of samples.

1.1.1 <u>Cleaning of Sensitive Equipment</u> The term “sensitive equipment” herein refers to scientific instruments used to measure field water quality parameters at monitoring wells. These instruments include pH and temperature meters and electrical conductivity meters. These instruments should be cleaned carefully due to their delicate construction and inability to withstand high-temperature steam cleaning.

Between samples sensitive equipment shall be cleaned using only distilled water as the rinse. A soft cloth and a soft-bristled plastic scrub brush can be used to remove resistant surface residues. Extreme caution shall be used when cleaning scientific instruments to avoid abrasion, bending, or cracking of the instrument probes, cables, and moving parts. Any physical damage to the instruments could result in incorrect readings which may not be detected until after the sampling round has been completed, thus possibly requiring re-sampling of the station.

1.1.2 Cleaning of Non-Sensitive Equipment The term “non-sensitive equipment” herein refers to more rugged equipment used in the sampling process, such as the pumps and bailer. At the start of each day of sampling the non-sensitive equipment shall be steam cleaned or thoroughly cleaned with a phosphate-free detergent and rinsed with distilled water. After sampling each well, the equipment shall be cleansed using a solution of a phosphate-free detergent in water and then rinsed with distilled water.

Sampling personnel who steam clean the non-sensitive equipment shall wear heavy duty water-proof gloves and eye protection to protect contact with steam and metal spray nozzle.

Preferably, the steam cleaner shall be centrally located in a garage or service building which has ready access to standard culinary water taps and 110-volt electrical outlets. The building in which the steam cleaner is operated must have adequate ventilation during cleaning operations.

Prior to starting the steam cleaner on any given day, the fuel tank of the steam cleaner shall be checked for sufficient fuel. Fuels must be handled in approved containers and stored in accordance with ATK safety procedures. If the system runs short of fuel, the fuel pump must be primed.

When daily cleaning operations commence, the steam cleaner shall be located such that the hose will reach outside of the building to the equipment to be cleaned. The exhaust port of the steam cleaner must be well away from any flammable materials. The discharge hose of the steam cleaner shall be positioned away from any materials that may melt.

The pump and bailer will then be steam cleaning and rinsed with distilled water. Both the pump and bailer are steam cleaned and rinsed inside and outside.

1.1.3 Cleaning of Filtration Equipment As will be discussed in subsequent sections, selected samples may be filtered in the field to remove particulate matter. All portions of equipment used in sample filtration which comes into contact with the sample water shall be thoroughly cleaned prior to each sampling campaign. The silicone tubing on the peristaltic pump that drives the filtration unit shall be cleaned by operating the peristaltic pump on the continuous forward setting while pumping the following sequence of cleaning fluids through the tubing:

- 500 ml of 20% hydrochloric acid solution (HC1)
- 2 quarts distilled water

Cleaning procedures shall provide for collection of cleaning fluids and spillage.

After each sample is filtered during a given sampling campaign, the filter shall be disconnected and discarded. The filtering system shall be cleaned by pumping the following sequence of cleaning fluids through the tubing:

- 500 ml of 20% hydrochloric acid solution (HCl)
- 2 quarts of distilled water

1.2 MEASUREMENT OF FIELD WATER-QUALITY PARAMETERS

The measurement of field water-quality parameters shall be performed at each monitoring well prior to sample collection. Field water-quality parameters to be measured include pH, temperature, and electrical conductivity.

These parameters are general indications of field water-quality conditions at the collection point. Since changes in these parameters occur with time, subsequent laboratory analyses are often not as accurate as properly performed field measurements. Therefore, it is critical that great care be taken when performing field measurements, to ensure that data are accurate.

Instruments used to measure pH, temperature, and electrical conductivity shall be removed from their protective cases during use to prevent the accumulation of moisture within the cases. Operation of the instruments shall take place within an enclosed area (i.e., within the cabin of the sampling vehicle) during periods of precipitation.

1.2.1 Electrical Conductivity The collection of electrical conductivity measurements shall be performed by means of a portable electrical conductivity meter. Instrument calibration shall be checked by measuring the specific conductance of potassium chloride solutions obtained commercially from a chemical supplier.

Water to be used for conductivity measurements shall be collected in a clean stainless steel, glass or Teflon™ container. The conductivity probe shall be rinsed thoroughly with water from the sample container and then inserted vertically into the container. The water level within the container shall be sufficient to immerse the probe to a depth at which sample water covers 2-inches above the bottom of the probe. The conductivity probe shall not be immersed above the point at which the control wires enter the top of the instrument probe. The conductivity probe shall be gently agitated after immersion into the water sample to release air trapped within the probe chamber. Failure to remove the air within the probe will result in incorrect instrument readings.

After inserting the probe into the sample water and displacing all air trapped within the probe chambers, the conductivity shall be read and recorded directly onto the appropriate sampling form. The instrument probe shall be rinsed with distilled water prior to returning the probe and meter to their storage area.

1.2.2 pH and Temperature The collection of pH and temperature data shall be accomplished by means of a portable pH meter. The pH meter shall be calibrated at the start of each sampling day. Calibration shall be performed according to manufacturers specifications. The time of each calibration will be recorded on the field log for future reference. Buffer solution data recorded during calibration shall include (1) the manufacturer, (2) the production lot number, (3) the pH, and (4) the expiration data.

Field measurements of pH and temperature shall be taken by collecting a sample of water from the monitoring well in a reusable, clean container dedicated for that purpose. Bottles intended for sample storage shall not be used for this purpose. A portion of the water from the sample cup shall be used to rinse the temperature and pH probes, after which the probes shall be placed vertically into the sample cup. The water in the sample cup shall be of sufficient depth to immerse the probes to a depth of at least 2 inches. After immersing the instrument probes, the pH and temperature values of the sample shall be determined. pH measurements shall be read to the nearest 0.02 unit and temperature to the nearest 0.1°C. Values of pH and temperature shall be recorded onto the appropriate sampling field log. Instrument probes shall be rinsed with distilled water immediately after use at each well.

1.3 DOCUMENTATION OF CHAIN OF CUSTODY

Water-quality sampling, preservation, shipment, and documentation must comply with the appropriate protocol to ensure that data are representative of in-situ conditions. Therefore, detailed records need to be maintained to provide both quality assurance and quality control in the sampling program. The term "chain of custody" refers to the process of ensuring the integrity of a sample from the time of collection to the time of data reporting. This includes the ability to trace the possession and handling of the sample from the point of collection in the field to the analytical laboratory, and includes the analysis and final disposition of the sample.

A sample is considered to be in a person's custody if it is (1) in a person's physical possession, (2) in view of the person after he has taken possession, (3) secured by that person so that no one can tamper with the sample, or (4) secured by that person in an area which is restricted to authorized personnel. The components of chain of custody include analysis request forms, sample labels, chain of custody forms, field-log forms, and custody seals (commercial shipments only). The procedures for their use are described in the following sections.

1.3.1 <u>Analysis Request Forms</u> Prior to the start of each sampling campaign, an Analysis Request Form (ARF) shall be prepared for each monitoring well. A typical ARF is shown in Figure 1-1. The ARF includes information on each specific bottle. Each bottle type corresponds to a given set of analyses as defined by the laboratory. The analyses to be performed may change between sampling campaigns as required.

The ARF shall specify the quantity and type of bottles to be collected from each sampling site and the chemical preservative required (if any) in each bottle. The ARF shall be used to ensure that the proper sample labels are present for each sampling site. Information on the ARF includes (1) the collector's signature, (2) field sample number, and (3) date sampled. The ARF will also dictate (1) the number of each bottle type included in the sample, (2) the preservative and field treatment used for each bottle, and (3) the requested analyses to be performed on the contents in each bottle.

Blind duplicates, equipment blanks, field blanks, and trip blanks shall have individual ARFs.

Figure 1-1

SECOND QUARTER 2007

ATK LAUNCH SYSTEMS
P.O. Box 98 Magna, UTAH 84044

SAMPLE NUMBER: GW-801 DATE: _____________ SAMPLER:______________________

ANALYTICAL LABORATORY: ATK Thiokol Environmental Testing Laboratory

Bottle Number	No. of Containers	Preservative/ Treatment	Requested Analysis
1	1	4 degrees C	NITRATE/NITRITE (EPA 300)
3	1	4 degrees C	HMX/RDX (SW-846, 8330 Mod) NG/DING (SW-846, 8330 Mod)
9	1	4 degrees C	Perchlorate (EPA 314)
11	3	0.2 ml HCL	Volatile Organics (SW-846, 8260)

1.**3.2** **Sample Labels** Sample labels are prepared in advance to prevent misidentification of samples to ensure correct bottles are filled. Gummed paper labels are adequate and shall include spaces for recording (1) sample number, (2) bottle number, (3) preservative information, (4) date and time of collection, and (5) name of the collector.

As the sample is collected the date, time, and collectors name shall be recorded on the sample labels. Labels are then attached to sample bottles before leaving sample site.

1.3.3 **Chain of Custody Forms** To establish the documentation necessary to trace sample possession from the time of collection, a chain of custody form shall be filled out and accompany the samples recorded on the form. A typical chain of custody form is illustrated in Figure 1-2.

After the collected samples are recorded in the spaces provided on the chain of custody form, the collector shall sign the form and place it with the samples to await transportation to the laboratory. Because the samples are in the custody of the collector, he shall not leave the samples unattended at sampling sites or at other locations where the samples may be tampered with. When the samples are relinquished the collector shall sign the appropriate relinquishment box on the form.

1.3.4 **Custody Seals** Custody seals are used to detect unauthorized tampering with the containers used to ship the samples commercially. The seal must be attached to the shipping container such that it is necessary to break the seal to open the shipping container. The custody seal must be affixed to the shipping container before the samples leave the custody of the sampling personnel. Shipping tape should be placed over the custody seal to prevent accidental breakage or removal during handling of the shipping containers. Figure 1-3 is an example of a typical custody seal.

1.3.5 **Sampling Log Forms** Field data (field parameters, water volumes, water depths, general observations, etc) shall be recorded on sampling log forms. Figure 1-4 is an example of a groundwater sampling field form to be used each time sampling operations are performed. Information to be recorded on the groundwater sampling log shall include, but not be limited to:

- Identification of monitoring well
- Signatures of sampling personnel
- General observations or unusual situations
- Date and time of sampling
- Water-level data
- Well depth
- Purge volume
- Water temperature, pH, and specific conductance

The Field Quality Control Sample Log documents collection of equipment blank (EB), field blank (FB), and trip blank (TB) (see Figure 1-5). A complete sampling log form shall be produced for each sampling station or well.

Figure 1-2
Chain of Custody Record

CHAIN OF CUSTODY Page ____ of _____

ATK LAUNCH SYSTEMS, P.O. BOX 98, MAGNA, UTAH 84404

Collected by:	Project: 2nd Quarter 2005 Groundwater Sampling
Contact:	Collection Location:
Telephone:	Work Order:

Turn Around Time: _________________

SAMPLE NUMBER	LAB	DATE SAMPLED	TIME SAMPLED	NUMBER OF BOTTLES	ANALYSIS REQUESTED

Relinquished by:	Received by:	Date/Time

Figure 1-3

SAMPLED BY ______________________________ ______________

SAMPLE NUMBER

DATE ________________ TIME ____________

Figure 1-4

Groundwater Sampling Field Log

ATK Launch Systems
Bacchus

Site ____________ Signature ______________________________
Date ____________ ______________________________
Time ____________ ______________________________

Calibration, pH

Instrument ______________________ Probe ____________
Time of two point calibration conducted today ________________ / __________________
Buffer pH 7.00 Source ________ Lot __________ Exp Date __________
pH 10.00 ________ __________ __________

Calibration, Conductivity

Instrument ____________________
Buffer conductivity __________ Source ______________ Lot __________________
Exp Date ________________

Purge Volume

Well depth (WD) ____________________ Depth to water (DTW) ____________________

Volume = 0.653* (WD - DTW) = __________________________

Purge volume = 3*Volume
= ____________________________

Field Parameters

Time	pH	Temperature (°C)	Conductivity (µmhos/cm)	Purged Volume (gallons)

Blind duplicate collected ______________________________

Comments

Figure 1-4 (Cont)

Groundwater Sampling Field Log (Page 2)

ATK Launch Systems
Bacchus

Well Head Inspection

Well No. ____________________
Date ____________________ Depth to water (ft) ______________________
Time ____________________

	Yes	No
Cracks in the concrete apron	______	______
Well cover	______	______
Well No. on well cover or casing	______	______
Lock to secure cover to casing	______	______
Well cap (cap to cover PVC)	______	______

Signature: ______________________________

____

Any of the above items needing repair/replacement should be noted below. What was repaired/ replaced, when it was repaired/replaced, and who made the repair/replacement should also be noted.

Comments: ____

Figure 1-5

Field Quality Control Sample Log

EB No. ________________ Date ____________________ Last sample location ____________________

Signature ____

Equipment to be tested ____

____

Time sampled ___________

Distilled Water Quality Check

Gal No.	pH	Temp °C	EC* µmhos/cm	Remarks
1				*Note: EC must be less than 10 umhos/cm
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Field blank				

Time sampled ___________

Trip blank ___________

Time labeled ___________

Taken to above well Yes _______________ No _______________

1.4 SAMPLE HANDLING PROCEDURES

When samples are collected, those requiring the removal of particulate matter and the addition of chemical preservatives shall be treated as described in the following sections. Also discussed are methods pertaining to sample packaging and shipping.

1.4.1 Sample Filtration Samples requiring filtration must be filtered at the time of collection. Filtering equipment shall be assembled at the collection point. A clean filter shall not be installed until filtering of samples is required.

A clean disposable plastic bottle shall be used to collect the sample for filtering. These containers shall be discarded after each use. Sample water shall be collected immediately prior to filtering, using the appropriate methods outlined in Chapters 3 and 4. The intake end of the pump tubing shall be placed directly into the bottle containing the unfiltered sample. The discharge end of the pump tubing shall be pushed firmly onto the intake port of the filter. The pump control shall then be switched to the on position and allowed to run until the tubing and filter have been flushed with sample water. The sample collection bottle for the filtered sample shall then be placed beneath the filter discharge port and filled.

After filling, the bottle shall be removed from beneath the filter discharge port and capped firmly. The intake end of the pump tubing shall be removed from the collection bottle and the pump shall remain running until the pump tubing and filter have been purged of sample water. Intake shall be placed in a container of distilled water and thoroughly rinsed. After rinsing, the pump shall be decontaminated as described in Section 1.1.3.

Samples, from wells with dedicated pumps, and requiring filtration shall be collected after all other samples have been collected at that well. Samples shall be filtered using an inline filter. The filter shall be attached to the discharge end of the dedicated pump discharge tubing or portable pump discharge hose. The sample collection bottle for the filtered sample shall then be place beneath the filter discharge port. After filling the collection bottle the filter is removed and discarded.

1.4.2 Sample Preservation The Analysis Request Form (ARF) (Figure 1-1) indicates the types of preservatives required for each sample bottle. All samples shall be cooled to 4°C upon collection regardless of their chemical preservation unless advised otherwise.

Chemical preservatives are listed on the ARF by type and amount of preservative required. Chemical preservatives include sulfuric acid (H_2SO_4, 50%), nitric acid (HNO_3, 50%), and hydrochloric acid (HC1, 50%). All of the chemical preservatives are corrosive and must be treated with caution. Sampling personnel shall avoid skin or eye contact with the preservatives and wear safety glasses and disposable waterproof gloves for protection at all times during handling. Sample preservation shall be performed in an area where large quantities of water are available for irrigation; should skin or eye contact occur. The sample preservation shall be conducted in a well-ventilated area to prevent buildup of dangerous fumes produced by chemical reactions.

Chemical preservatives shall be added to bottles prior to sample collection, if practical, to facilitate mixing of the preservative with the sample and to allow immediate “fixing” of the samples following collection. The sample collection bottles shall have a minimum amount of preservative solutions as specified on the ARF. Preservative solutions shall be transferred from storage bottles to sample collection bottles by using dedicated pipettes. One pipette shall be used for each type of liquid preservative and under no circumstances shall they be used to transfer more than one type of compound. Only one preservative solution shall be open at any given time during bottle preservation to prevent accidental mixing of preservative solutions.

1.4.3 Sample Shipping Procedures Immediately following the collection of samples, the bottles shall be placed in ice chest or refrigerator for storage and subsequent transport to the analytical laboratory. Prior to shipment, bottles and shipping containers shall be prepared in a manner which will enable sample bottles to arrive undamaged and suitable for accurate analysis. Sample bottles shall be shipped to the analytical laboratory to ensure that holding times may be satisfied.

1.4.3.1 Sample Packing and Shipping Container Preparation Samples collected during each day's sampling operations shall be placed in ice chest shipping containers with crushed ice and or ice packs assembled in a central area prior to shipment.

Glass bottles shall be placed in protective foam sleeves and all bottles shall be checked for cap tightness. Caps shall be tightened as required to prevent any sample leakage during transport. Sampling personnel shall inventory the sample bottles from each sampling site prior to shipment to ensure that all samples listed on the ARF are present.

1.4.3.2 Shipping Instructions Each shipping container shall contain an ARF listing required analyses for each sample bottle within the container. After entering all required information on the form, sampling personnel shall send the ARF to the laboratory along with samples.

A Chain of Custody form shall also accompany each shipment of samples. Sampling personnel shall enter all necessary information on to the form. Sampling personnel shall sign their name and the time relinquished in the proper location on the form. Following completion of the form, sampling personnel shall obtain a copy of the Chain of Custody for subsequent filing.

The appropriate copies of the analysis request and chain of custody forms shall be placed inside a waterproof plastic bag and then placed inside the shipping container prior to sealing of the container when shipping commercial. Care shall be taken to ensure that the correct forms are included in each cooler.

An adhesive shipping label addressed to the analytical laboratory and containing the return address of the shipper shall be securely affixed to the top center of the shipping container when shipping commercially. The container shall be securely closed and latched, and an adhesive custody seal completed by the shipper with his signature and the date shall be placed across the transition between the container body and lid in such a way that it cannot be opened without breaking the seal. This will notify the analytical laboratory if samples have been tampered with during shipment. After applying address and custody labels, clear plastic sealing tape shall be applied liberally to the container to secure the lid to the body to prevent it from opening during shipment. Tape shall also be used to secure the address label and custody seal to the shipping container.

1.5 FIELD QUALITY CONTROL

A fundamental part of a water-quality monitoring program is the establishment of quality control programs to ensure the reliability and validity of field data. Quality control procedures shall include the collection of equipment blanks, field blanks, trip blanks, and blind duplicates. These samples are collected as an aid in determining sample biases introduced by equipment decontamination procedures, bottle handling, laboratory procedures, transportation procedures, and random errors.

The number of quality control samples to be collected during a groundwater sampling campaign shall be equal to ten percent of the total number of monitoring wells (rounded to the nearest whole number). For example, if there are 73 monitoring wells, 7 quality control samples will be collected. The wells selected for quality control will be selected randomly. The random selection process shall be accomplished by drawing numbers from a container or by using random number generator.

1.5.1 **<u>Equipment Blanks</u>** The purpose of an equipment blank is to verify the effectiveness of procedures for cleaning the sampling equipment between individual samples. Equipment blanks, therefore, aid in quantifying sample bias due to collection procedures.

Prior to collecting equipment blanks, the standard equipment cleaning procedures shall be completed (see Section 1.1). A stainless steel cylinder shall be steam cleaned and rinsed with distilled water. The cylinder shall then be filled with distilled water and the pH, temperatures, and conductivity shall be measured. The equipment (bailer) shall be inserted in the cylinder and withdrawn. Samples shall then be obtained from the cylinder and field parameters; pH, temperature, electrical conductivity measured and recorded. All data collected during the equipment blank process shall be recorded on the field log (Figure 1-5). Equipment blanks shall be labeled EB-1 for the first blank, EB-2 for the second blank, etc. Samples collected from the monitoring wells shall be analyzed for the same parameters selected for the monitoring wells. Records shall be kept to indicate the wells sampled immediately prior to the collection of each equipment blank.

In the event that a random selection of wells includes a well that has a dedicated system, a equipment blank will not be collected from that well but the other quality control samples (field blank and trip blank) will be collected and recorded on the field log form.

1.5.2 **<u>Field Blanks</u>** Each time an quality control sample is collected, a field blank shall also be collected. The field blank consists of distilled water collected directly from the distilled water containers. The field blank is submitted for analyses to confirm the purity of the commercially obtained distilled water and thus monitor the possibility of false positive results in the equipment blank. Distilled water for a field blank shall be collected from the group of bottles of distilled water used for the equipment blank. The same types and number of sample bottles used for the equipment shall be used for the field blank. Field blanks shall be labeled FB-1 for the first blank, FB-2 for the second blank, etc. Field blank pH, electrical conductivity, and temperature shall be recorded on the field log along with other information as appropriate.

1.5.3 **<u>Trip Blanks</u>** For each sampling campaign, a set of sample bottles of each type will be pre-filled with distilled or deionized water. A set of these bottles (referred to as trip blanks) shall be transported to the sampling site that is sampled just prior to each equipment blank (i.e., one trip blank per quality control sample). The trip blank bottles shall be handled identically to the handling procedures for bottles used for sample collection. The trip blanks shall be subjected to the same analyses as the water sampled at the respective sampling sites. Trip blanks serve to indicate (1) if interaction between the sample and the container is occurring, (2) if a handling procedure alters the analytical results, and (3) if the sample bottles are being properly cleaned and rinsed before field use. Trip blanks shall be labeled TB-1 for the first blank, TB-2 for the second blank, etc. Appropriate information shall be recorded on the field log for each trip blank.

1.5.4 **<u>Blind Duplicates</u>** A blind duplicate consists of a duplicate sample collected from a monitoring well. This duplicate is provided with an arbitrary sample number and is, therefore, submitted "blind" to the laboratory without their knowledge of which station the sample was obtained from. The dual set of samples from the same sampling location allows detection of possible laboratory bias.

During each sampling campaign, ATK shall randomly select ten percent of the monitoring wells for collection of blind duplicates. Each blind duplicate shall be given a false identification number (e.g., GW-124) which will appear to correspond to an actual monitoring well. This method of numbering shall be used to prevent laboratory personnel from knowing the source of the duplicate sample.

A suite of sample bottles identical to those used at the monitoring well being duplicated shall be used for each blind duplicate. Both the blind duplicate and "real" sample bottles shall be filled at the same time and in an identical manner according to standard sampling procedures. Both sets of sample bottles shall be handled, packed, preserved, and shipped in the same manner and in the same or similar shipping container(s).

Blind duplicates shall be labeled using a "GW" heading and a number which is greater than those used for "real" samples. Table 1 lists numbers historically used (through December 1986) for blind duplicates and corresponding "real" samples. Successively higher three-digit numbers shall be used to denote blind duplicate collected at monitoring wells. Sampling personnel shall document all blind duplicates collected and the "real" samples that they correspond to. This will allow subsequent correlation of the water chemistry data.

Table 1

Groundwater Blind Duplicate Summary

Blind Duplicate Number	Sample Number	Date (Mo/Yr)
GW-101	GW-11	12/85
GW-102	GW-36	12/85
GW-103	GW-37	12/85
GW-104	GW-28	12/85
GW-105	GW-09	01/86
GW-106	GW-13	02/86
GW-107	GW-04	02/86
GW-108	GW-14	03/86
GW-109	GW-06	03/86
GW-110	GW-24	03/86
GW-111	GW-33	03/86
GW-112	GW-07	06/86
GW-113	GW-12	06/86
GW-114	GW-25	06/86
GW-115	GW-34	06/86
GW-116	GW-14	09/86
GW-117	GW-15	09/86
GW-118	GW-36	09/86
GW-119	GW-05	09/86
GW-120	GW-10	12/86
GW-121	GW-35	12/86
GW-122	GW-38	12/86
GW-123	GW-26	12/86

1.6 ACQUISITION AND ORDERING OF SAMPLING SUPPLIES

Prior to beginning a sampling campaign, sampling personnel shall check all equipment to ensure it is in proper working order. Personnel shall also inventory all disposable sampling supplies and ensure that quantities required to complete the upcoming sampling campaign are available. Equipment shall be maintained and repaired by sampling personnel in accordance with the manufacturer's instructions.

Disposable sampling supplies shall be ordered in sufficient quantity to provide an excess of each item required to complete the sampling round. Disposable supplies include sample bottles, shipping containers and packing material, required forms and labels, chemical preservatives, buffer and calibrating solutions for pH and conductivity meters, filters, disposable gloves and other safety equipment, distilled water, and disposable paper towels. Sample bottles and supplies shall be obtained in adequate time to ensure that the materials will be available.

1.7 RECORDS MANAGEMENT

The original signed and dated sample logs or an electronic equivalent log form are considered the legal sampling record of the site. All forms shall be kept on file for future program auditing and analysis review. All monitoring data, field logs, and maintenance records, shall be recorded and archived for future reference.

2.0 SAMPLE COLLECTION

2.1 WATER LEVEL MEASUREMENT

The protocol set forth in this chapter were prepared by means of guidelines present in UAC 315-3-3.1(h)(2) and 40 CFR sub-part 264.97 section 4f as promulgated by the EPA, and the September 1992 edition of the RCRA TEGD. These regulations and guidance documents should be reviewed when updated to ensure that procedures are conducted in a manner that is in keeping with current regulatory requirements.

The collection of static water levels on a continuing basis from monitoring wells at the Bacchus Works is important in determining possible changes in horizontal and vertical flow gradients. This chapter describes procedures used in collecting water-level measurements from the monitoring wells. A determination of the ground-water surface elevation will be conducted each time ground water is sampled as stipulated in 40 CFR 264.97 4f.

2.1.1 Equipment Water-level measurements shall be obtained by means of an electronic water level indicator. The water level indicator consists of a probe sheathed in plastic, 300 feet of plastic-coated transmitting cable, and a light/buzzer. The system operates by means of an open electronic circuit which is closed upon contact with the water surface in the well casing. The light and buzzer at the ground surface indicates when the electrical circuit is closed.

2.1.2 Quality Control Upon arrival at each well site, proceed to complete the checklist shown on page 2 of Figure 1-5. The locking cover of the protective outer well casing shall be carefully removed and visually inspected for cleanliness. To avoid contamination during the measurement process, or cross-contamination between wells, the probe and cable of the measuring unit shall not be allowed to contact the ground surface or other potential sources of contaminants. The immersed portioned shall be thoroughly rinsed with distilled water after measurements are completed at each well. The probe and cable shall be visibly inspected during each use for foreign materials (e.g., soil, oil, etc). If present, these materials shall be removed to reduce the chance of anthropogenic contamination of the wells.

2.1.3 Measurement Procedure The water-level indicator shall be checked in accordance with manufacturer's instructions to ensure that it is working properly prior to measuring the wells. Care shall be taken to lower the cable of the water level indicator such that the cable does not rub on the edge of the well casing and thus damage footage markers on the cable which are used for measurement.

The sampling personnel shall consult the log book in which previous water-level measurements were recorded to define an approximate depth to the water surface. Knowledge of previous water levels allows the sampling personnel to anticipate the approximate depth at which the probe will encounter the water surface. The cable can then be lowered into the well at an efficient rate and the rate can be reduced near the depth of anticipated contact.

As soon as the probe contacts the water surface, the circuit will be completed and the light and buzzer flash and beep. The sampling personnel shall then carefully raise and lower the cable in reference to the top of the protective outer casing to precisely determine the depth to water. The cable shall then be read directly to the nearest 0.01 foot and recorded on the appropriate field data sheet.

After the probe is retrieved from the well the probe shall be rinsed with distilled water. The protective cap shall then be carefully replaced on the inner well casing. Care shall be taken to ensure that the locking cap of the protective outer well casing is secured to preclude unauthorized access to the inner well casing.

2.2 SAMPLING ORDER OF MONITORING WELLS

The specific hose and pump used to purge a well is a function of whether the well has a dedicated pumping system or is purged with a portable pump and reel. In general, contaminated wells will be sampled after non-contaminated wells. Although specific purge and sample systems are described below, other methods may be employed if they meet guidelines approved by the USEPA and Utah DSHW.

2.3 WELL PURGING AND SAMPLE COLLECTION

2.3.1 Pre-sampling Operations

Prior to the use of equipment at a well, the equipment shall be cleaned as specified in Section 1.1.2. All bottles shall be prepared for sampling, and the paperwork shall be prepared so that paperwork effort in the field can be minimized.

2.3.2 Purge Operation

Purging will be conducted to remove stagnant and stratified water from the well casing and ensure that the sample collected is representative of the monitored aquifer. This step of the sampling operation shall be undertaken only after measurement of static water levels.

2.3.3 Purge Equipment The purging system shall consist of a dedicated stainless steel submersible pump or a portable stainless steel submersible pump connected to Teflon coated hose on a reel. Various combinations of pump sizes and hose sizes will be required to purge wells depending on the depth and size of the well. Stainless steel fittings shall be used to connect the equipment components. A stainless steel or Teflon bailer may also be used for purging the well.

2.3.4 3-Volume Purging Procedures Prior to the commencement of purging operations instruments used to monitor the chemistry of the discharged water shall be calibrated according to manufacturers specifications.

The cap and cover of the well shall be removed. The pump shall be lowered until slack develops in the hose, which indicates the pump is on the well bottom. The pump shall then be raised one to five feet above the well bottom to insure that it is in contact with the screened interval. The discharge hose shall be connected and placed in a 2- to 5-gallon bucket. The pump shall be started and the well shall be pumped until the purge volume has been removed. This volume may be measured by filling buckets or drums to a calibrated mark or by measuring the flow rate and purging the well for a calculated period of time.

Wells may be purged by a dedicated pump system. A hose is attached to fitting on top of well where water is discharged. The discharge hose shall be placed into a measuring bucket or 55 gallon drums. The pump then will be plugged into the generator and the well shall be pumped until the required purge volume has been removed. This volume may be measured by filling buckets or drums to a calibrated mark or by measuring the flow rate and purging the well for a calculated period of time.

Wells may also be purged using a stainless steel or Teflon bailer. The bailer shall be connected to the cable and shall be positioned directly above the well. The bailer shall be lowered until it is completely immersed (when possible) and permitted to fill with water. The bailer shall be raised and emptied. This procedure shall be repeated until the purge volume has been removed.

Water pumped from contaminated monitoring wells shall be discharged to drums placed adjacent to the wells for the collection of contaminated water. Care shall be exercised to ensure that a minimal amount of the water from these wells discharges to the surface. In the event that new monitoring wells are installed at the Bacchus Works, water purged from the new wells shall be discharged into drums and held until results of analyses are received to dictate the necessary disposal requirements.

Samples of the discharging water shall be collected in a cup dedicated for measurement of pH, specific conductance, and temperature. All field measurements shall be performed on samples collected in the sample cup (i.e., probes shall not be inserted into sample bottles which will be shipped to the laboratory). All field data and the time at which they were collected shall be recorded on the sampling log form (Figure 1-5).

The well shall be purged until values of pH stabilize. This parameter shall be considered stable when readings from three successive samples lie within plus or minus 0.1 pH units.

2.3.5 Low Flow Purging The objective of low-flow purging is to pump in a manner that minimizes stress (drawdown) or disturbance to the ground-water flow system to the extent practical. Low flow purging will generally follow the procedures outlined below.

In situations where a well is screened or open across a single zone of interest, and that zone is comprised of nearly homogeneous geologic materials, the pump intake should be positioned at or near the mid-point of the well screen. In this type of situation, the water that is withdrawn will likely represent the water quality of the entire screened zone, even at low-flow pumping rates. In situations in which the geology of the screened zone consists of heterogeneous materials with layers of contrasting hydraulic conductivity, the pump intake should be positioned adjacent to the zone of highest hydraulic conductivity (as defined by geologic samples).

In general, the pumping rate used during low-flow purging and sampling must be low enough to minimize mobilization and entrainment of particulate matter and to minimize hydraulic stress on the well and the formation (for example, to minimize drawdown and to eliminate inclusion of stagnant water from the casing in the sample).

After the pump intake is properly set in the well, the pump should be started at a low pumping rate, generally 1 gpm or less. From the time the pump is started, the water level in the well should be measured to determine the amount of drawdown caused by pumping. If drawdown is rapid and continuous, the pumping rate should be lowered until drawdown decreases and stabilizes. If drawdown is very slow or imperceptible, the pumping rate may be raised slowly and adjusted to the point at which drawdown stabilizes. The maximum pumping rate used for sampling should not exceed the rate used for purging.

Water quality parameters will be measured at the five minute mark and will include: pH, conductivity (or specific conductance), and temperature. Once the five minute mark is reached, groundwater samples will be collected from the discharge hose at a rate equal to or less than 1 gpm.

2.3.6 Low Yield Wells Monitoring wells that are low yielding wells occasionally purge dry before 3-volumes are purged from the well. In the event that the well purges dry, the water level in the well will be allowed to recover to within 80% of the pre-pumping level. Once recovered, the well will be sampled without additional purging.

2.3.6 Sample Withdrawal After the well is stabilized, the ground water shall be sampled using either a stainless steel or Teflon bailer or taken directly from the pump discharge hose. Dedicated wells may be sampled using a bladder pump and controller or a Grundfos RediFlo pump and controller. The controller shall be adjusted to maintain a steady flow rate while sampling. The bailer shall be used as described above to collect water. Water-proof disposable gloves shall be worn during sampling. These gloves shall be disposed of after sampling activities are completed at each well. All bottles listed on the analysis request form shall be filled directly from the bailer except the 4D bottle. Filtered water for the 4D bottle will be collected in a plastic disposable container prior to filling the sample bottles. At dedicated wells, sample bottles shall be filled from the end of the Teflon or polyethylene discharge tubing.

Bottles shall be filled in the following order:

1. Volatile organics (VOA); 40 mL glass bottle No. 11
2. Explosives (e.g. NG, HMX); 500 mL glass bottle No. 3
3. Perchlorate; 250 mL polyethylene bottle No. 9
4. Nitrate/Nitrite; 500 mL nalgene bottle No. 1

Bottles in which sample portions are collected for analysis of volatile constituents (i.e., Bottles 11), shall be filled gently from the bottom up and immediately capped without headspace. To check for headspace, the bottle shall be turned up-side-down after it is capped. If bubbles appear at the bottom of the bottle, the bottle must be uncapped and additional liquid must be added to eliminate all air space within the bottle.

After collection of each sample, the time of collection shall be recorded in the field log, on the sample label, and on the chain of custody form (Figure 1-2). The collector shall then initial or sign all the forms, labels, and field logs as appropriate to certify that sampling of that particular well is complete. Each sample bottle shall be affixed with a sample label after sample collection (see Section 1.3.2 of Chapter 1 for discussion).

2.3.7 <u>New Monitoring Wells</u> ATK periodically installs new monitoring wells to refine the understanding of contaminant migration on and offsite of the Bacchus Works. In the event that a new monitoring well is installed, ATK proposes to collect four sets of quarterly groundwater samples for the constituents listed in Table 2. This list of analytes have been used for previous baseline chemistry at the Bacchus Works. Once the four quarterly sampling events have been accomplished, the new monitoring well will revert to annual sampling unless otherwise agreed upon with the Division.

2.3.8 <u>Sample Handling</u> Refer to Section 1.4 of Chapter 1 for discussion of sample preservation and sample shipping procedures.

2.3.9 <u>Field Quality Control</u> Refer to Section 1.5 of Chapter 1 for discussion of sample blanks and duplicates.

2.3.10 <u>Records</u> Refer to Sections 1.7.

2.4 SAMPLE COLLECTION SCHEDULE

The ground water monitoring wells will be sampled annually.

3.0 ANALYSIS OF GROUND WATER SAMPLES

All samples will be analyzed by a state certified laboratory, using EPA or State approved analytical methods. If there is not an established EPA or State approved analytical method, the Utah DSHW will be notified of the proposed analytical method.

If the laboratory is not State certified to do a specific analysis, the laboratory will subcontract a qualified laboratory to do the analysis. Table 3 lists the wells to be sampled and sampling frequency for each well at and downgradient of the Bacchus Works. Samples will also be analyzed for the field water quality parameters pH, temperature, and conductance.

Table 2

NEW MONITORING WELL ANALYTE LIST

Bottle Number	No. of Containers	Preservative/ Treatment	Analysis
1	2	4 degrees C	General Parameters Alkalinity, Aluminum, Calcium, Chloride Fluoride, Iron, Magnesium Potassium, Sodium, Sulfate, TDS TSS, Zinc
1	1	4 degrees C	NITRATE/NITRITE (EPA 300)
3	1	4 degrees C	HMX/RDX (SW-846, 8330 Mod) NG/DING (SW-846, 8330 Mod)
4d	1	5 ml HNO3	METALS (EPA 6010)
9	1	4 degrees C	Perchlorate (EPA 314)
11	3	0.2 ml HCL	Volatile Organics (SW-846, 8260)

Table 2-2

Gwoundwater Sampling Protocol

ATK Launch Systems

Bacchus Facility

UTD001705029

Well	Volatiles	Field Parameters	Nitrate/ Nitrite	General Monitoring Parameters	Metals	Perchlorate	HMX/RDX	NG/DiNG
GW-1	Annual	Annual				Annual		
GW-2		Annual				Annual		
GW-3		Annual				Annual		
GW-4	Annual	Annual				Annual		
GW-5	Annual	Annual				Annual		
GW-6	Annual	Annual				Annual		
GW-7		Annual				Annual		
GW-8		Annual	Annual			Annual		
GW-9		Annual				Annual		
GW-10	Annual	Annual	Annual			Annual	Annual	
GW-11		Annual				Annual		
GW-12	Annual	Annual				Annual	Annual	
GW-13	Annual	Annual	Annual			Annual	Annual	Annual
GW-14	Annual	Annual				Annual		
GW-15	Annual	Annual				Annual		
GW-16		Annual				Annual		
GW-17								Annual
GW-18		Annual				Annual	Annual	
GW-19	Annual	Annual				Annual	Annual	
GW-20	Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-21	Annual	Annual				Annual	Annual	
GW-22								
GW-23								
GW-24		Annual				Annual	Annual	
GW-25		Annual				Annual	Annual	

Table 2-2

Gwoundwater Sampling Protocol

ATK Launch Systems

Bacchus Facility

UTD001705029

Well	Volatiles	Field Parameters	Nitrate/ Nitrite	General Monitoring Parameters	Metals	Perchlorate	HMX/RDX	NG/DiNG
GW-26	Annual	Annual				Annual		
GW-27								
GW-28	Annual	Annual				Annual		
GW-29	Annual	Annual				Annual		
GW-30	Annual	Annual				Annual	Annual	
GW-31		Annual				Annual	Annual	
GW-32						Annual		
GW-33	Annual	Annual				Annual		
GW-34	Semi-Annual	Semi-Annual				Semi-Annual		
GW-35	Semi-Annual	Semi-Annual				Semi-Annual		
GW-36	Semi-Annual	Semi-Annual				Semi-Annual		
GW-37								
GW-38		Annual				Annual	Annual	
GW-39		Annual				Annual	Annual	
GW-40		Annual				Annual	Annual	
GW-41	Annual	Annual				Annual		
GW-42		Annual				Annual		
GW-43	Annual	Annual				Annual		
GW-44		Annual				Annual	Annual	
GW-45								
GW-46		Annual				Annual		
GW-47		Annual				Annual	Annual	
GW-48	Annual	Annual				Annual		
GW-49	Annual	Annual				Annual	Annual	
GW-50	Annual	Annual				Annual		

Table 2-2
Gwoundwater Sampling Protocol
ATK Launch Systems
Bacchus Facility
UTD001705029

Well	Volatiles	Field Parameters	Nitrate/ Nitrite	General Monitoring Parameters	Metals	Perchlorate	HMX/RDX	NG/DiNG
GW-51	Annual	Annual				Annual		
GW-52								
GW-53		Annual	Annual			Annual		
GW-54	Semi-Annual	Semi-Annual				Semi-Annual		
GW-55								
GW-56	Semi-Annual	Semi-Annual				Semi-Annual		
GW-57	Semi-Annual	Semi-Annual				Semi-Annual		
GW-58	Semi-Annual	Semi-Annual						
GW-59	Annual	Annual				Annual		
GW-60	Annual	Annual						
GW-61	Semi-Annual	Semi-Annual						
GW-62	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-63	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-64	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-65	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-66	Semi-Annual	Semi-Annual	Annual	Annual		Semi-Annual	Semi-Annual	
GW-67	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-68	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-69	Annual	Annual				Annual	Annual	
GW-70	Semi-Annual	Semi-Annual				Semi-Annual	Semi-Annual	
GW-71	Annual	Annual				Annual		
GW-72	Semi-Annual	Semi-Annual				Semi-Annual		
GW-73		Annual	Annual			Annual		
GW-74		Annual				Annual		
GW-75		Annual	Annual			Annual		

Table 2-2

Gwoundwater Sampling Protocol

ATK Launch Systems

Bacchus Facility

UTD001705029

Well	Volatiles	Field Parameters	Nitrate/ Nitrite	General Monitoring Parameters	Metals	Perchlorate	HMX/RDX	NG/DiNG
GW-76	Semi-Annual	Semi-Annual				Semi-Annual		
GW-77	Annual	Annual				Annual	Annual	
GW-78	Semi-Annual	Semi-Annual				Semi-Annual		
GW-791	Quarterly	Quarterly		Quarterly		Quarterly		
GW-792	Quarterly	Quarterly		Quarterly		Quarterly		
GW-801	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
GW-802	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
GW-803	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly